Sanitary Survey Report

Hopi High School – BIA Public Water System
PWSID #0400395

Survey Conducted for the
Environmental Protection Agency
Region 9

March 23, 2018

Sanitary Survey Conducted
by

Dan L. Fraser, P.E., and JanDee May
Sleeping Giant Environmental Consultants, LLP

for

Emmanuelle Rapicavoli, P.E.
Program Manager

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A. Introduction

On March 23, 2018, Dan Fraser, P.E., and JanDee May, of Sleeping Giant Environmental Consultants, LLP (SGEC), conducted a sanitary survey of the Hopi High School – Bureau of Indian Affairs (BIA) Public Water System (PWS). SGEC is an independent contractor that performs sanitary surveys for the U.S. Environmental Protection Agency's Region 9 (EPA Region 9). SGEC was assisted during the sanitary survey by:

- Chuck Villa, Water Operator, Hopi High School – BIA PWS
- Emmanuelle Rapicavoli, P.E., Program Manager, EPA Region 9
- Brett Gleitsmann, Circuit Rider, Rural Community Assistance Corporation (RCAC)

EPA Region 9 implements the Safe Drinking Water Act and regulations regarding public water systems[1] as they apply to most of the PWSs on Tribal lands in Region 9. Sanitary surveys of PWSs are an important component of EPA Region 9's direct implementation program and are critical for protecting the health of water users. They are comprehensive evaluations of a PWS's above-ground facilities, management and operation. During the sanitary survey, above-ground facilities are inspected, records are obtained and reviewed, and operators and managers are interviewed. PWS components evaluated include:

1. source(s)
2. treatment
3. storage
4. pumping facilities
5. operator compliance with training and certification requirements
6. management and operations
7. distribution system (including cross-connection control)
8. monitoring, reporting and data verification (This component of the sanitary survey is addressed by SGEC only superficially as it is an area handled by the EPA Region 9 program manager.)

[1] *40 CFR Part 141 – National Primary Drinking Water Regulations*

The purpose of the sanitary survey is to determine if the PWS's facilities and its operation and management provide consumers with adequate protection from waterborne pathogens and other contaminants. If deficiencies in public health protection are identified, SGEC provides recommendations for corrective actions.

B. Description of the System

The Hopi High School - BIA PWS is located approximately six miles west of Keams Canyon and a mile south off Highway 264. The PWS serves the Hopi Junior High School, Hopi High School and the Northland Pioneer College.

The PWS has 48 residential connections for school staff with a residential population of approximately 88. All the residences are currently occupied. Ten non-residential connections serve nine school buildings and the Northland Pioneer College Hopi Center. All connections are metered. The PWS serves 425 students and 153 staff at the Hopi Junior/Senior High School and an estimated 200 persons at the Northland Pioneer College Hopi Center. Non-transient users, including non-residential staff and students of the Hopi Junior/Senior High School and Northland Pioneer College, are estimated to be approximately 690 people. The transient population of 133 is based on daily visitors, high school sporting events, career fairs and other school activities. Chuck Villa is the maintenance foreman and primary water operator.

The PWS is classified as a community public water system because it serves more than 25 residential users. Therefore, the PWS is regulated for both acute (having health effects over the short term) and chronic (having health effects when consumed over the long term) contaminants. The school is owned by the BIA and, as a grant school, is operated by the Hopi Tribe under a grant from the Bureau of Indian Education (BIE).

The PWS has three wells, but only Well 2 (GW002) and Well 1 (GW001) are used. GW002 is the primary well and GW001 is only used to meet high summertime demands because it does not have treatment for arsenic removal. When GW001 is used, it is first flushed to waste stagnant water. Per the operator, GW001 is used less than 30 days each year. GW003 is not used due to a total dissolved solids (TDS) level that exceeds those of GW001 and GW002. It is physically disconnected from the PWS but could be put in service under emergency circumstances.

The system has two storage tanks; however, one (ST002) essentially serves as a wet well for a pumping facility that fills ST001. This tank is a 7,000-gallon fully buried tank that does not meet typical design standards for potable water storage. The primary storage tank (ST001) is an elevated 250,000-gallon welded steel tank that floats on the distribution system. GW001 is disinfected (TP002) and GW002 is treated for removal of arsenic and TDS prior to disinfection and temporary storage in ST002. From ST001, a single transfer pump (PF001) pumps GW002's treated water into the distribution system (DS001) and fills ST001. All above ground PWS facilities are now protected by security fences.

Following is a more detailed description of the water system components. Deficiencies and recommendations are numbered in order of their priority at the end of the narrative. The sanitary survey form in Section II contains additional information and photographs of the system are in Section III of the report.

C. Sources

As noted above, the Hopi High School – BIA PWS has three wells, only two of which are currently in use. GW003 can be reconnected and put into service if needed. Reportedly, all three wells have high concentrations of TDS and concentrations of arsenic that exceed the maximum contaminant level (MCL). Only GW002 and GW003 can receive treatment for TDS and arsenic, and currently only GW002 is plumbed into TP001 which is designed to provide treatment for TDS and arsenic.

GW001/Well 1 – Photo 2: In the past, GW001 has been inactive due to high levels of arsenic and TDS. Currently, the well is used, per the operator, up to 30 days per year. When GW001 is used, it pumps directly into the distribution system, with chlorination as the only treatment provided.

The well is located in the school's maintenance compound along with ST001, the elevated tank, and TP002, its disinfection facility. The compound is within a chain-link fence with locking gate. The well casing is near the building that houses TP002 and only a few yards from ST001. The casing extends four inches in height above the grading that has taken place since the last sanitary survey. The casing is no longer vulnerable to pooling of water around the casing and it does not appear to be at risk of flooding. The casing now has a sanitary seal but there is no casing vent. All the sanitary seal's bolts are in place and tight and electrical wires are within conduit.

GW001 was drilled in 1985 to a depth of 925 feet and has a 30-horsepower (hp) submersible pump that produces 65-67 gallons per minute (gpm).

Deficiencies:

- The casing does not have a vent.
- The well does not have treatment for arsenic removal.

GW002/Well 2 – Photos 4-5: GW002 is the primary well and is located north of the high school near the building that houses the reverse osmosis (RO) treatment facility (TP001). Since the last sanitary survey, a security fence has been erected that encloses GW002, TP001 and the underground storage tank (ST002). The security fence's gate was not locked. The enclosure is well maintained and free of vegetation and debris

The well's casing extends 11 inches in height above the grading that has taken place since the last sanitary survey. The casing is no longer vulnerable to pooling of water around the casing and does not appear to be vulnerable to flooding. The casing now has a sanitary seal but there is no casing vent. All the sanitary seal's bolts are in place and tight and electrical wires are within conduit.

GW002 was drilled in 1984 to a depth of 1,088 feet and is cased with 8-inch diameter steel to 918 feet. No information was provided on slotting or screening and it appears to be an open hole from 918 feet to the total depth. The static water level was at 428 feet at the time of its construction. It was test-pumped at 80 gpm and the drawdown stabilized at 792.5 feet for the final four hours of pumping. In 2015, Dean Downey of RCAC measured the static water level at 575 feet. Assuming his measurements are accurate, the aquifer's water level has fallen 147 feet since 1984.

A new submersible pump was installed in 2014. Its specifications were not made available to SGEC, but it reportedly produces up to 72 gpm. Water hammer has been a problem and the operator has remodeled the discharge piping and throttled the well's production to about 65 gpm. It is turned on and off manually along with the RO treatment plant and transfer pump.

Deficiencies:

- The casing does not have a vent.
- The system has water hammer problems when the well pump starts.
- Security gate was not locked.

GW003/Well3 – Photos 6-8: GW003 is located 500 yards north of GW002. It was drilled in 1985 to a depth of 1,048 feet and cased with 8-inch diameter steel to the full depth. The casing is slotted from 848 – 1,048 feet. This well is not in use and has been physically disconnected from the PWS because its level of TDS is reported to be higher than that of GW002. If necessary, this well could be put back in service. The well can reportedly produce up to 100 gpm.

When in use, its discharge line goes to TP001 via a vault that contains a conductivity meter. It is designed to waste water to the lagoon until the TDS falls to an acceptable level. At that point, the well water can be routed to the RO plant. If the well is put back in service, plumbing inside the treatment building would have to be modified so the well's water would receive treatment for arsenic removal, RO and disinfection. For the long-term, this might be more cost effective than providing similar treatment for GW001.

The well casing extends 13 inches in height above the grading that has taken place since the last sanitary survey. It now has a sanitary seal but no casing vent. All bolts of the sanitary seal are in place and tight and electrical wires are within conduit.

Since the last sanitary survey, a security fence has been erected that encloses both GW003 and TP002. The gate was not locked. The enclosure is well maintained and free of vegetation and debris.

Deficiencies:

- The casing does not have a vent.
- Security gate was not locked.

D. Treatment

The system has a total of four treatment plants but only two are currently active. Stand-alone disinfection facilities for GW002 and GW003 are still in place but no longer used because the water from both wells can be pumped through TP001 which includes disinfection as well as arsenic removal and RO. The RO plant (TP001) is a multiple stage process that includes cartridge filtration, an adsorption process, RO and post-chlorination. TP002 is a sodium hypochlorite disinfection system for GW001.

TP001/Reverse Osmosis Treatment Plant – Photos 4 and 9-12: TP001 is located a few yards north of GW002 and shares a secured enclosure with the well and ST002. TP001 can treat water from either GW002 or GW003 but does not have enough capacity to treat the flows from both wells simultaneously. The treatment plant facilities are within a locked metal building that is clean and well maintained. As noted above, this treatment plant typically treats the water pumped from GW002 which is throttled to about 65 gpm to prevent water hammer.

As the water enters the building, it is first passed through two parallel vessels containing 5-micron cartridge filters for particle removal. Next, the water passes through a vessel of KDF® zinc and copper based adsorptive medium (Photo 9). This proprietary medium is advertised as an electro-chemical oxidation-reduction process effective for removal of chlorine, iron, hydrogen sulfide and heavy metals, including arsenic. This vessel also contains granular activated carbon (GAC) that is effective for removing chlorine and organic compounds. The head to move the water through these initial treatment processes is provided by the well pump(s).

Water from the KDF® vessel flows to the suction side of a high-pressure centrifugal pump that feeds the RO membranes (Photos 10-11). A continuous sample stream of the RO treated water is measured for conductivity. The treated water is injected with sodium hypochlorite solution for disinfection purposes before it enters the 7,000-gallon buried storage tank (Photo 13). The chlorine solution tank does not have secondary containment. The chlorination unit uses sodium hypochlorite that is certified by the National Sanitation Foundation (NSF). At the time of the sanitary survey, the 12.5 percent sodium hypochlorite solution was being diluted to 0.09 percent (i.e., less than one-tenth of one percent) and no measurable free chlorine residual could be found in the distribution system or at the treatment plant. SGEC recommended that the chlorine solution's concentration be increased to one or two percent and the metering pump's feed rate adjusted to ensure 0.20 milligrams per liter (mg/L) free chlorine throughout the distribution system.

The RO membranes apparently no longer function to remove TDS and the high-pressure pump is not needed. SGEC suspects the membranes may be broken, allowing water to flow freely through one or more of the RO units. Since the time of the sanitary survey, the operator has fabricated a bypass for the RO membranes and is now bypassing all the water after it has received treatment for arsenic removal.

The brine from the RO process flows by gravity to the school's wastewater lagoons. When the RO system is functional, wastewater produced from the membrane cleaning process also flows to the lagoons.

Deficiencies:

- The sodium hypochlorite solution day tank does not have secondary containment (Photo 12).
- Insufficient chlorine is being injected. There was no measurable chlorine residual in the distribution system.
- The RO system is reportedly no longer functional. Therefore, the finished water has high concentrations of TDS and objectionable tastes.

TP002/Chlorination Unit for GW001 – Photo 3: TP002 is in a building located within the same fenced and locked compound as GW001 and ST001. It consists of a positive displacement chemical metering pump and day tank for storage of the chlorine solution. The chlorination tank does not have secondary containment. A flow switch stops and starts the chemical metering pump. The inside of the building is very clean and well kept.

Deficiencies:

- The treatment plant does not remove arsenic.
- The chlorine day tank does not have secondary containment.

E. Finished Water Storage

The PWS has both an elevated storage tank and an underground storage tank. The underground tank serves only as a clearwell for the water treated by TP001 and a wet well for PF001. Water from this tank is pumped into the distribution system by a transfer pump (PF001).

ST001/Elevated Storage Tank – Photo 15: ST001 is a 250,000-gallon welded steel pedestal storage tank that was constructed in 1985. ST001 is located within a secured compound along with GW001 and TP002. It was professionally cleaned and rehabilitated in 2010. At that time, the standpipe was replaced due to excessive corrosion and leakage. The tank appears to be in excellent condition. Since the time of the 2012 sanitary survey, the tank's vent screen has been replaced with a double screen consisting of a heavy mesh bird screen covered by an insect screen. Due to high winds, SGEC did not climb the tank in 2018 to inspect the vent and screen. Brett Gleitsmann of RCAC said he had inspected the screen recently and found it in good condition (Photo 15).

The overflow is a stubbed pipe at the base of the pedestal, a foot or so above ground. The overflow is screened with heavy, large mesh screen that should be replaced with 12-mesh screen or smaller. A concrete splash pad beneath the overflow pipe has been added since the last sanitary survey. There is no sign of erosion and the tank is near the facilities management shop where overflows would be quickly noticed. The target is operational but the target cable housing continues to be open and could allow the entrance of insects into the water. Unfortunately, the housing is located at a significant height above grade with no safe method of access.

There are insufficient safety railings at the top of the tank.

Deficiencies:

- The water level target housing is open to insects.
- Mesh on the overflow pipe is too large to keep out insects.
- There are insufficient safety railings at the top of the tank.

ST002/Buried RO-Treated Water Storage Tank – Photos 4 and 13: ST002 is located just north of TP001. It is completely buried, making its examination impossible for potential entry points for contaminants. The tank does not meet standards for potable water storage tanks. The tank has a screened inverted U-type vent but no overflow. The access hatch is bolted in place.

Since the 2015 sanitary survey, a security fence has been erected that encloses GW002, TP001 and ST002. The gate was not locked. The enclosure is well maintained and free of vegetation and debris.

Deficiencies:

- The fully buried storage tank does not meet standards for a potable water storage tank. It is not possible to examine the tank for potential entry points for contaminants.
- The security gate is not locked.

F. Pumps, Pumping Facilities and Controls

The system has a single pumping facility to transfer treated water from TP001 to the distribution system.

PF001/Transfer Pump for Treated Water – Photo 13-14: A single 5-hp centrifugal pump is located in the building that houses TP001. It takes suction from ST002 and pumps the treated water into the distribution system through a 4-inch diameter polyvinyl chloride (PVC) water main. This transfer pump is controlled manually with GW002 and TP001. A vertical pipe (Photo 13) is located between the building and ST002 and, per the operator, has to be used to prime the pump. The hose used for priming the pump does not appear to be designed for use with potable water and it is left open-ended on the floor (Photo 14).

Deficiencies:

- The pump must be primed each time it is used. The priming procedure offers opportunities for contamination of the water.

G. Monitoring, Reporting and Data Verification

The PWS has an approved site sampling plan and up to date monitoring schedule. Compliance with monitoring, reporting and data verification is not a responsibility of SGEC as it is handled by the EPA Region 9 program manager.

Deficiencies:

- None that SGEC is aware of.

H. Distribution System

DS001/PWS #0400395 Distribution System – Photos 16-19: The distribution system is made up of 4-inch, 6-inch and 8-inch diameter schedule 80 PVC water mains. Mains are looped through the service area and are buried a minimum of four feet deep for frost protection. The system has fire hydrants and is hydraulically capable of providing fire protection. The mains were installed in 1986 and are in good condition without leaks. The PWS now has standard operating procedures for water main repair, disinfection, flushing and testing.

The system does not have a formal cross-connection control program but has reduced pressure zone backflow prevention assemblies that are reportedly tested annually. A double gate, double check backflow prevention assembly was located on the water line to the chiller. One of the fire sprinkler risers has a double check backflow prevention assembly (Photo 17) while another did not (Photo 16). Some of the wet fire sprinkler systems are served from dedicated service lines. The operator thought there might be backflow assemblies in the service line vaults (Photo 16) but that seems unlikely to SGEC.

Deficiencies:

- Documentation should be available to show all high-risk services and facilities are provided with appropriate backflow protection and that assemblies are tested annually.
- The PWS does not appear to have a formal cross-connection control program that ensures that high-risk connections have backflow prevention and that all backflow prevention assemblies are tested annually.

I. Management and Operation

The Hopi High School PWS is owned by the BIA, and the BIE contracts with the Hopi Tribe and provides a grant to operate and maintain the facilities. The school is administered by a five-member school board and a superintendent (Steven Berbeco). There is not a separate budget for the water/sewer operations. These expenses are simply part of the school's operating and maintenance budget. There is no fee structure for water users. The residential connections and the Northland Pioneer College are not charged for water.

Garlyn Navakuku is the facility manager and reports to the school superintendent who in turn reports to the school board. Garlyn supervises Chuck Villa, the water operator. Chuck Villa is certified at level one for treatment and distribution by the Inter Tribal Council of Arizona, Inc. (ITCA).

Facilities management staff has developed an operations and maintenance manual that includes standard operating procedures. There is a safety program with regular tailgate meetings and monthly trainings provided by the facility manager. As a BIA school, there is a continuity of operations plan (COOP) that serves as an emergency response plan.

An extensive file of monitoring results and information on the PWS is kept in the facilities management building (Photo 20).

Deficiencies:

- The PWS does not have a formal cross-connection control program. SGEC was unable to determine if all wet fire sprinkler systems have backflow protection or if the existing assemblies are being tested annually. Documentation was requested but not provided.

J. Operator Compliance with EPA Requirements

Chuck Villa is the maintenance foreman and has been the water operator at Hopi High School for many years. He is certified at level one for treatment and has received his level one certificate for distribution since the last sanitary survey. ITCA is the certifying agency. Chris Perry is a school custodian who also serves as backup water operator for Chuck Villa as necessary. Chris is not certified.

Deficiencies:

- The backup operator is not certified.

K. Deficiencies and Recommendations

Following is a list of deficiencies and recommendations for the system based on information gathered during the sanitary survey. Each deficiency is ranked in order of severity and is assigned a **Health Risk Priority** number.

> Deficiencies assigned a **Health Risk Priority 1** present a serious health risk. Health Risk Priority 1 deficiencies should be corrected immediately.
>
> Deficiencies assigned a **Health Risk Priority 2** present a critical system defect, critical operational defect, or potential health hazard. Health Risk Priority 2 deficiencies should be corrected as soon as possible.
>
> Deficiencies assigned a **Health Risk Priority 3** present a critical system defect, critical operational defect, or potential health hazard, but are not as significant as Health Risk Priority 2. Health Risk Priority 3 deficiencies should be corrected as workload allows.
>
> Deficiencies assigned a **Health Risk Priority 4** present a system defect, operational defect, or potential contamination hazard and are costly to correct. Health Risk Priority 4 deficiencies should be addressed in any long-range water system improvement project.
>
> Deficiencies assigned a **Health Risk Priority 0** are suggestions for improvement, but are not a health risk.
>
> Deficiencies are identified by SGEC but final Health Risk Priority numbers are assigned by the EPA Region 9 program manager.

1. **Use of Arsenic Non-Compliant Ground Water Source (GW001, TP002 – S4, T2 – Health Risk Priority 1) – Photos 2-3.** Historic arsenic monitoring data from

GW001 show arsenic levels ranging from 18-19 micrograms per liter, which exceeds EPA's primary drinking water standard for arsenic of 10 micrograms per liter. Per EPA Region 9, sample dates showing MCL exceedences include: 5/25/2010, 10/20/2009 and 12/26/2001. Water from GW001 is not treated for arsenic prior to entering the distribution system. The water operator stated that the PWS utilizes this well approximately 30 days per year.

Recommendation: If the well is used, its entry point should be monitored in accordance with an EPA Region 9-approved monitoring schedule and treatment should be provided for arsenic removal. The EPA Region 9 program manager should be provided with a plan and schedule to ensure compliance.

2. **Full-time Disinfection (GW002, TP001 – T1 – Health Risk Priority 1) – Photo 12.** The operator said that he prepared the chlorine day tank solution by mixing one gallon of 12.5 percent sodium hypochlorite solution with approximately 135 gallons of water. This produces a highly diluted chlorine solution and no chlorine residual could be measured at the treatment plant or in the distribution system. This issue was discussed during the sanitary survey and SGEC recommended changing the dilution process to achieve somewhere between a one and two percent solution.

   Recommendation: SGEC recommends mixing the 12.5 percent sodium hypochlorite solution at a ratio of one gallon of sodium hypochlorite solution to 12 gallons of water to get approximately a one percent solution. Then, the metering pump's feed rate should be adjusted to the point where a chlorine residual of approximately 1.0 mg/L is achieved in the effluent from PF001. Over time, the metering pump's feed rate can be adjusted as necessary to ensure that there is always a minimum of 0.20 mg/L free chlorine residual at all points in the distribution system. For the first few months following these adjustments in the chlorine feed rate, daily chlorine residuals should be taken in the distribution system with the results recorded and submitted to the EPA Region 9 program manager at the end of each month. Most of the chlorine residual measurements should be taken in the school building(s) where students and staff are normally served, However, SGEC recommends that at least one residual measurement per week be taken (and recorded) at the furthest point in the distribution system.

   The operator reported that a few water users had complained about chlorine tastes and/or odors. SGEC believes it's worthwhile to point out that tastes and odors are more obnoxious at very low chlorine residuals than when there is a measurable free chlorine residual. This is because chlorine reacts with organics in the water, either originating from the well water or from biofilms in distribution and storage, to produce mono-, di- and tri-chloramines. Dichloramines and trichloramines have obnoxious tastes and odors. If enough chlorine is injected to pass the break point and produce a free chlorine residual, the bad tastes and odors are significantly diminished. Some people will be able to get a slight chlorine odor from off-gassing, but they can be advised to put a pitcher of water in the refrigerator and that odor will be lost as the gas escapes.

3. **Priming the Pump (PF001 – P2 – Health Risk Priority 1) - Photo 14 and Figure 1.** Per the operator, PF001's pump has to be primed every time water is pumped from ST002 into the distribution system. The pump is primed with water from the distribution system provided through a hose that was coiled up on the floor of the treatment building during the sanitary survey. This process offers opportunities for contamination of the water system.

   Given the current design with an above grade pump and a fully buried storage tank, this may not be a problem that is easy to correct. Until it can be corrected, a standard operating procedure (SOP) needs to be developed that minimizes the opportunities for contamination of the water during the pump priming process.

   Recommendation: A standard operating procedure should be developed to ensure that the water system is not contaminated during the pump priming process. Things to consider when designing the SOP include:

   a. The conduit used to carry water from the distribution system to the point where the water is introduced for priming the pump should be designed for use with drinking water. Ideally it should be NSF- certified for use with potable water.

   b. The conduit should not be used for any other purpose and should be drained after each use.

   c. The conduit should be flushed to waste before each use.

   d. Both ends of the conduit should be capped when not in use.

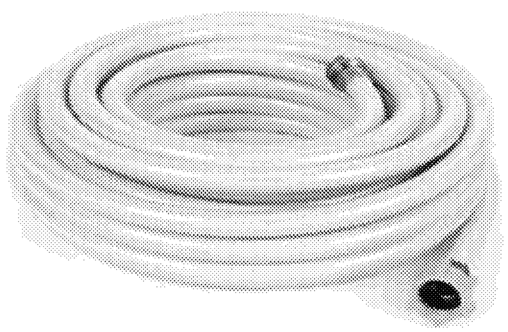

Figure 1 - Photo of TastePURE Drinking Water Hose

4. **Storage Tank Deficiency (ST001– ST1 – Health Risk Priority 1) - Photo 15 and Figure 2.** The overflow for the elevated storage tank is stubbed out near the foundation of the tank where a splash pad has been installed to prevent erosion and protect the tank's foundation. The overflow is screened but the openings in the screen are too large to prevent the entry of water-seeking insects like bees and wasps.

   Recommendation: The screen should be replaced with a non-corrodible screen with openings no larger than 12-mesh (12 openings per inch both vertically and horizontally). The existing screen appears to be 4-mesh.

   Another acceptable method of providing protection for overflows is to install a weighted flap gate. In theory, the flap gate will open to allow overflowing water to escape and then will close when the overflow ceases. An example of a flap gate is shown in Figure 2 below.

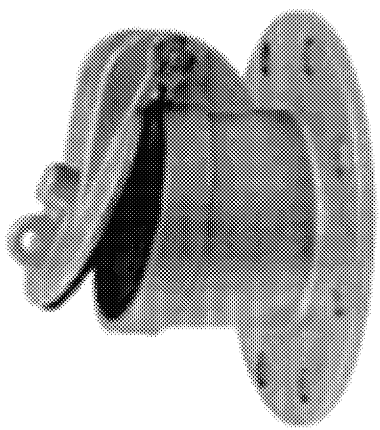

Figure 2 - Example of a flap gate.

   Note that Figure 2 shows the end of the overflow pipe has been cut at a slight angle to ensure a more tightly closing valve. Some regulatory agencies prefer to have overflows with both a flap gate and internal insect screen. Regardless of the method selected to protect overflows from insects and vermin, regular inspection and maintenance is required. Screens corrode and need regular replacement and flap gates need to be lubricated and cleaned to ensure free movement and sealing.

5. **Substandard Storage Tank (ST002 – ST2, ST4 – Health Risk Priority 2) - Photos 4 and 13.** The small buried storage tank does not meet current standards for storage of potable water. It is fully buried with no overflow and no way for an operator to inspect it for leakage or potential of contaminant entry.

Recommendation: The tank should be replaced with an above grade storage tank that meets current design standards. SGEC recommends that the tank have more capacity, so the water production and pumping rates will not have to be so closely matched to avoid repeated starting and stopping of pumps.

6. **Appropriate Certification and Backup Operator (O1, – Health Risk Priority 2).** The operator is not certified in treatment at the appropriate level (T-2) and the backup operator is not certified.

   Recommendation: The operator should obtain level two certification in treatment and the backup operator should be encouraged to become appropriately certified in both distribution and treatment.

7. **Target Cable Housing (ST001 – ST1 – Health Risk Priority 2) - Photo 15 and Figure 3.** The tank has a functional target; however, the housing for the target cable is not well sealed around the cable. The opening can allow insects to enter the storage tank. The cable housing's opening is over 100 feet above ground which will offer some protection against insects while making corrective action very difficult.

   Recommendation: When the tank is inspected by a tank rehabilitation company, the target cable housing should be protected against the entry of insects. An option favored by the Region 9 program manager (and likely one of the best long term fixes) is to cover the lower few inches of the target cable housing with an appropriately-sized PVC cap.

Figure 3 - Installation of a PVC cap.

The PVC cap can be inserted over the cable guide opening after a small hole is drilled at the appropriate location[2] in the cap (approximately 1/8 -1/4-inch diameter) and the cap is slit to slide over the cable. The cap and slit can be

[2] Not all target cables are centered in the housing's opening.

caulked to fill the slit and attach the cap. The cap could be attached using a small sheet metal screw to make it more permanent and a hose clamp could be used to minimize the openings created by the slit. An example is shown in Figure 3 above. Due to the inaccessible location, a solution should be designed to be as permanent as possible.

8. **Reverse Osmosis Treatment (TP001 - T1 – Health Risk Priority 2).** The RO portion of TP001 is reportedly not functioning and the TDS of the water sources (GW002 and GW003) are very high. When on site, SGEC was told that students and faculty rarely drink the water because of the tastes imparted by the dissolved solids. When water users are forced to search for more palatable sources of drinking water, they often find sources that are more palatable but less safe. It is important for the PWS to provide finished water that is both palatable and safe for drinking.

   Recommendation: The PWS should have the RO system's problems diagnosed and corrected.

9. **Cross-connection Control – (DS001 – D3 - Health Risk Priority 2):** The PWS does not have a formal cross-connection control program. The school has several backflow prevention assemblies, but one wet fire sprinkler system appears to have no backflow protection on its riser (Photo 16). The backflow prevention assemblies that were inspected by SGEC did not show any evidence of having been tested in the past 12 months. They should be tagged with the testing results or other documentation should be available.

   Backflow prevention assemblies should be tested on an annual basis by someone who is properly certified to do so. This is necessary to ensure that the assemblies are in working condition and capable of preventing contamination of the drinking water with dangerous chemicals such as the corrosion inhibitors commonly used in school boilers. This is a relatively complex system with numerous high-risk components that should be separated from the distribution system by appropriate backflow prevention assemblies. A formal cross-connection control program is essential to ensure the drinking water cannot be contaminated by backflow.

   Recommendation: A cross-connection control program should be established by the PWS. The program should include measures to ensure backflow prevention assemblies are in place and tested at least annually. The assemblies should be properly tagged at the time of testing and detailed records should be kept regarding testing results and corrective measures implemented.

   Guidance for developing and implementing a cross-connection control program can be obtained from EPA's web site. Two of these documents can be found at the following sites:

   https://www.epa.gov/sites/production/files/2015-09/documents/epa816r03002_0.pdf https://www.epa.gov/sites/production/files/2015-09/documents/epa816f06035.pdf

The American Water Works Association also has a manual on cross-connection control (AWWA Manual M14 – *Recommended Practice for Backflow Prevention and Cross-Connection Control)*. That manual can be purchased at:

https://www.awwa.org/publications/manuals-of-practice.aspx.

Probably the best source of detailed information is the Foundation for Cross-Connection Control and Hydraulic Research at the University of Southern California (http://fccchr.usc.edu/) .

The type of cross-connection control program appropriate for the Hopi High School – BIA PWS should not be particularly costly or time-consuming. It is, however, very important and necessary for the protection of the health of the water users.

10. **Backflow Protection (DS001 – D3 – Health Risk Priority 2) - Photos 16-17.** During the sanitary survey, backflow prevention assemblies could not be found for one of fire sprinkler risers that was inspected (Photo 16). There are below-grade vaults outside the building where double gate double check valve assemblies may be located. In any event, these wet sprinkler systems should be separated from the distribution system by appropriate backflow prevention assemblies.

    One of the fire sprinkler systems was fitted with a double check backflow prevention assembly (Photo 17).

    Recommendation: The service lines for the fire sprinkler risers should be checked to see if backflow protection is provided in the below grade vaults or at some other location. If there is no protection for the wet sprinkler systems, it should be installed as soon as possible.

11. **Casing Vents (GW001, GW002, GW003 – S4 – Health Risk Priority 2) - Photos 2, 4, 7 and Figures 4 and 5.** The three wells are all equipped with new sanitary seals. However, the sanitary seals do not have downward-facing screened vents. As water moves up and down in the well casings, during and after pumping, the casing's internal air pressure will change. Thus, air will be attempting to move into and out of the casings to equalize the pressure. With no dedicated vents, the air will move through the electrical conduits. This can force moist air into electrical controls causing corrosion and may allow contaminants to enter the casing. For example, if the buried conduit is submerged in shallow ground water, that water can be siphoned into the well casing. For these reasons, it is best to have properly designed dedicated vents.

    Recommendation: Properly designed vents should be installed on all three wells. The sanitary seals now on the wells have a threaded port that is designed to accommodate a vent (Figure 4). This kind of vent should be available from the supplier of the sanitary seals.

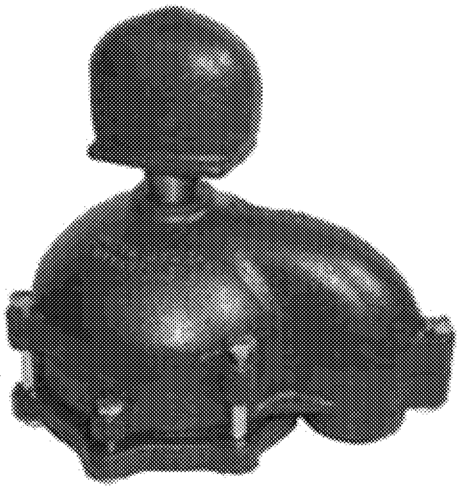

Figure 4 - Sanitary seal with protected and screened vent.

Alternatively, a vent can be fabricated from appropriately sized and threaded galvanized iron pipe using three short lengths of pipe and two elbows. These materials can be used to fabricate a vent that is shaped like an inverted U, similar to the storage tank vent shown in Figure 5 below. It should be protected against insects by installation of a non-corrodible screen with openings no larger than 16-mesh. EPA Region 9 recommends 24-mesh non-corrodible screen.

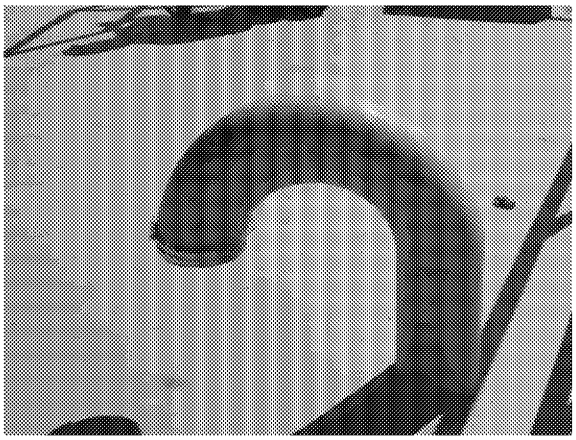

Figure 5 - An inverted U-type vent.

12. **Security (GW002, GW003, TP001 – M5 – Health Risk Priority 3).** Two of the wells (GW002 and GW003) and the RO treatment plant (TP001) are now protected by chain-link security fences. However, the fences' gates were not locked at the time of the survey.

    Recommendation: The fence gates and building doors should always remain locked.

13. **Safety (ST001 – ST2 – Health Risk Priority 3).** The elevated storage tank does not have safety railings around the vent and manhole. This makes climbing the tank unsafe, particularly so during high winds.

    Recommendation: The tank should be provided with safety railings.

14. **Water Hammer (GW001 – S2, S3 – Health Risk Priority 3).** The well's submersible pump discharge line must be throttled to prevent damage by water hammer.

    Recommendation: An engineering firm should be engaged to diagnose the causes of the water hammer and design preventive controls.

15. **Secondary Containment (TP001, TP002 – T2 – Health Risk Priority 3).** The chlorine solution day tanks do not have secondary containment. Leakage from the tanks could cause damage to the nearby facilities.

    Recommendation: Secondary containment should be provided.

II. Sanitary Survey Form

III. Photographs